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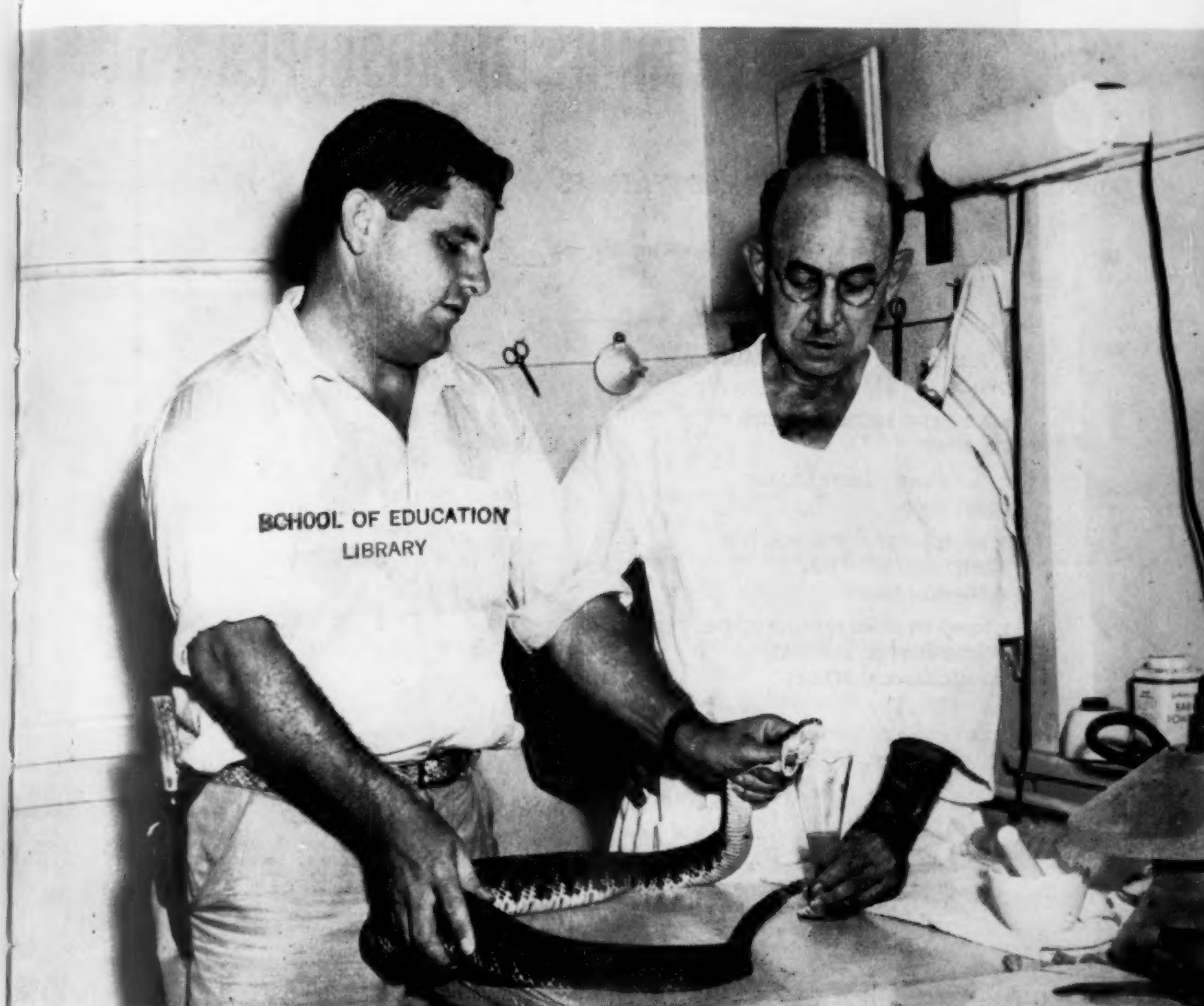

Project Method of Teaching

Using Maps in Biology

Audio-Visual News

THE AMERICAN BIOLOGY TEACHER

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Teachers and Students Invited

Teachers and students are invited to send in photographs to be used on the cover of future issues of THE AMERICAN BIOLOGY TEACHER. Please enclose brief description along with each picture.

Cover Photograph

Ross Allen and Dr. C. B. Pollard of Gainesville, Florida, extracting venom from a large rattlesnake in the laboratory at Ross Allen's Reptile Institute, Silver Springs, Florida. Photograph courtesy of Ross Allen's Reptile Institute.

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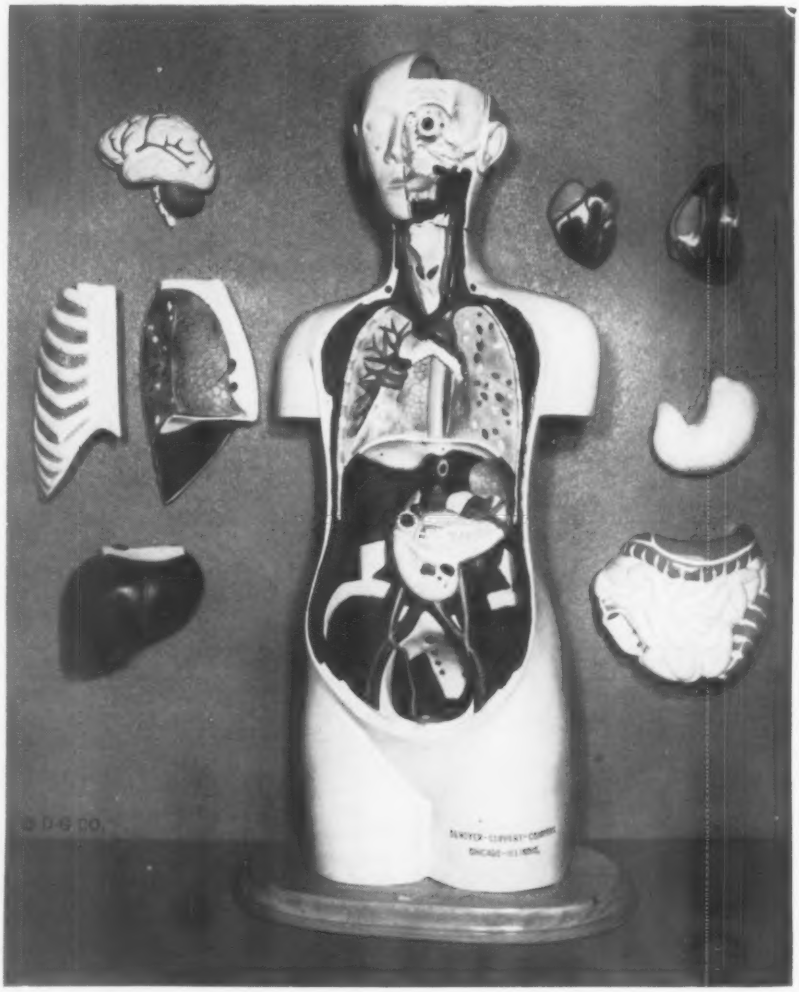

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The Project Method of Teaching Biology

LUTHER S. WEST
Department of Biology
Northern Michigan College
Marquette, Michigan

We are confronted at the present time with the responsibility of interesting a higher percentage of American youth in those areas usually referred to as the basic sciences. The relatively small numbers of high calibre students who have elected scientific careers in recent years has become a matter of anxiety both to industry and to our military organization. The nation is looking chiefly to the science teachers of the high schools and colleges to provide the inspiration which may correct and perhaps reverse this somewhat alarming trend.

As head of a department in a four-year teacher-training institution, it has been my responsibility (since 1938) to organize and conduct a course in Biological Methods for upper-class college students. Under personal stimulation of the late Webster H. Pearce[1], then president of Northern Michigan College, a course was developed with objectives considerably beyond the mere exposition of teaching method. These objectives, as finally evolved, are stated herewith:

Objectives of Biological Methods 410

1. To acquaint upper class students of biological science with various useful techniques not ordinarily acquired in conventional courses. Both teaching and laboratory procedures are included here.
2. To stress proper methods for searching out technical literature and preparing an annotated bibliography in a selected field of biological science.
3. To give practice in the planning and execution of a simple research project (the nature and extent of which will depend upon time and material available). Collecting, rearing, mounting, and experimental procedures are involved here.
4. To give practice in the preparation of various types of scientific manuscripts for publication, both popular and technical. Methods of illustrating scientific articles are likewise stressed.
5. To give practice in the presentation of scientific material before a group, including the preparation of demonstrations and of illustrative material for screen projection.
6. To acquaint the student with the names and locations of leading business houses which deal in scientific equipment and supplies and to give practice in the use of catalogs and other advertising material.

Except for three years during the war period, when the author was on leave for military purposes, the course has been in continuous operation. The maximum number of students registered at any one time was 24, a limit set by laboratory facilities.

With objectives as indicated above, registration is not necessarily limited to students in a teacher-training curriculum. It is rather a course in methods for the future biologist, whether he functions as a teacher, industrial scientist, experiment-station worker, conservationist, or museum employee. The course has sometimes been elected by future doctors, dentists, and public health workers. The tendency for today's science teachers to migrate between the classroom and other scientific employment, according to fluctuating salary schedules, would appear to justify common instruction at the undergraduate level and was one of the factors considered in setting up the course. Having proven its worth for all groups, this course is now required at Northern Michigan for the completion of a major in the

[1] Dr. Pearce served many years as Superintendent of Public Instruction for the State of Michigan and was thoroughly conversant with both educational methodology and subject matter problems.

biological sciences. The fact remains, however, that the majority of the students served are candidates for the teaching certificate at the secondary level. Of the 113 projects discussed below, 89 or 78.76 per cent were carried out by students who were either candidates for a state teaching certificate at the time the course was taken, or who qualified for the certificate at some later date.

Plan of the Course

The credit value of this course is three semester hours. *One* of these is earned by attendance at lecture-demonstrations conducted by the instructor. In these presentations an attempt is made to cover the technique of finding and using scientific literature, to acquaint the student with the names and locations of leading scientific supply houses, and to explain the basic methods of research procedure. This is followed by specific demonstrations on methods of collecting, preserving, mounting, and in some cases culturing plant and animal organisms of various groups. Some histological technique is included here, also. Concluding discussions pertain to the preparation of reports, and of manuscripts for publication. The last day is devoted to a consideration for career selection.

There is a final examination at the end of the course, covering the content of the lecture-discussions.

Two Credits Depend on Project

The remaining two credits of the course are earned through work on an individual project. The nature of this project is governed by (a) the student's preference, (b) his background training, and (c) his professional objectives.

It is with the nature and development of the *projects* that this paper is particularly concerned.

The student schedules 4 to 6 hours, each week, for work on his project. He also engages in a weekly conference with the instructor, much as a graduate student might do in developing his thesis. This insures the necessary guidance and counselling, including change of program when desirable.

The project, regardless of its character, involves three phases: (1) A search of the literature; (2) Field or laboratory procedure, frequently experimental; (3) The report. All three phases may be under way at the same time, or if the nature of the project permits, a definite amount of time may be allotted to each.

Before coming to his first conference the student fills out a form which indicates his background and interest. This insures that no student will undertake a project for which he does not have an appropriate background. Experience in other branches of science, such as chemistry, physics, geology, and mathematics has a very important bearing on selection.

The first interview is devoted to selecting a project and planning the initial steps. Sometimes this is merely a confirmation of a project determined in advance, on which the student may have already started to work. As the work unfolds, the student prepares for his weekly interviews by assembling notes, drawings, specimens and other material as a basis for discussion. The instructor keeps on file an interview sheet for each student in the course, entering such notes as will enable him to discuss any project, at any time, without unnecessary review of previous conferences.

Form used by Instructor, who makes Dated Entries in Connection with Weekly Interviews:

BIOLOGICAL METHODS 410

Name of Student:
Title of Project (Tentative):
Statement of Intended Procedure:

Interviews

No.	Date	Remarks

The student completes his obligation in the course by (a) preparing a display for public exhibition; (b) presenting a verbal report before an audience, preferably a high school group; (c) submitting a typed thesis, including illustrations, table of contents and bibliography. The thesis remains the property of

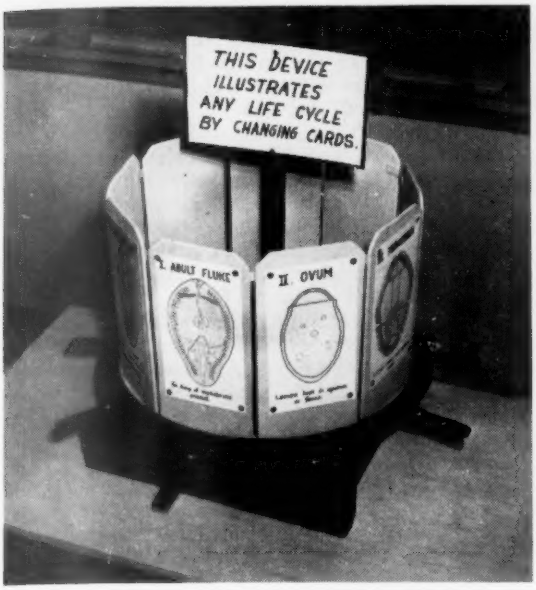

FIGURE 1. A class project designed to illustrate the life history of a lung fluke. The superstructure may be manually rotated, permitting the student to observe successive stages without changing his own position.

FIGURE 2. A two-foot anatomical model, constructed of wire cloth, plaster, and enamel paint. Five colors were used. The two smaller devices, into which air may be passed by means of rubber tubes, represent "vocal cords separated" (left) and "vocal cords approximated" (right). The latter arrangement emitted sound.

the college and becomes an integral part of the pamphlet library of the Department of Biology.

Diversity of Projects Chosen

An analysis of the last hundred and thirteen theses that have been completed and filed with our department shows an interesting and rather well-balanced spread of scientific interest. Each project is here classified according to dominant content, though many would have qualified in more than one classification. In the following summary each thesis has been entered only once, making the categories mutually exclusive.

Relation to High School Teaching

After several years' experience, we are recommending that the Project Course be taken by the college student in the junior year, so that he may have the benefit of such a background before undertaking his practice-teaching as a college senior. Under a sympathetic critic teacher, the student teacher can sometimes develop excellent projects with his high school practice group.

Northern Michigan College plays host each April to the Northern Michigan Science Fair, a regional exposition at which winners are selected to attend the National Science Fair in May. At the Regional Fair exhibits may be displayed by grade school, high school or college students. The latter category gives opportunity for our college projects to be exhibited, and a place is provided on the

Distribution of Projects in Subject Areas

Subject Matter Areas	Number	Percent
Projects stressing genetics and related interests	4	3.54—
Projects concerned chiefly with laboratory techniques	9	7.97—
Projects dealing primarily with animal morphology	10	8.85—
Projects in microbiology	12	10.62—
Projects emphasizing physiological processes	14	12.39—
Projects emphasizing conservation and field studies	14	12.39—
Projects emphasizing educational method	14	12.39—
Projects dealing principally with plant science	17	15.04+
[1]Projects dealing with entomology, parasitology and related fields	19	16.81+
Totals	113	100.00

[1]This figure reflects an unusually keen interest in tropical diseases and military medicine among returned veterans during the post-war years.

formal program for verbal presentation of the thesis reports. By this means, Objective 5 of the course in biological methods is adequately met.

The long-range value of this type of undergraduate preparation is now abundantly confirmed by the excellent and numerous high school science exhibits which appear at the regional fair each year, sponsored by teachers who themselves carried out science projects at the upper-class college level. The relation of such a program to the discovery and encouragement of scientifically talented boys and girls is clearly obvious. In large metropolitan high schools these ends are usually best served by the promotion of science clubs, as an extra-curricular activity. In the very large number of small town and consolidated high schools, where many students are transported by bus, the incorporation of the project into the *daily classroom procedure* is in many cases the only way to provide such experience. In the geographical region where the writer is located, this procedure is clearly preferable.

In lieu of bibliography, I have appended a list of ten very superior theses, several of which later served as a basis for technical publications.

Specimen Titles of Theses on File in the Pamphlet Library of the Department of Biology at Northern Michigan College

(The list includes one example from each of the nine categories set forth above, in addition to one title chosen at large.)

Allen, Kenneth W., Terrain Models for Ecological Study in High School Biology. (Educational Method). A remarkable device, providing for change of fauna and flora, according to season of the year.

Bowerman, Melvin, Special Techniques for Mounting and Staining Protozoa. (Laboratory Techniques). This student was "handminded." He became a successful general science teacher and school administrator.

Gill, Gordon D., Ecological and Life History Studies on the Simuliidae and Ceratopogonidae of Marquette County. (Entomology). This has been published as a technical paper. There is considerable demand for reprints.

Maki, Edna, The Forcing of Winter Buds with a View to Providing Floral Subjects for Art Instruction in the Schools. (General). An excellent example of the combining of interests for general educational purposes.

Manty, Roy R., The Hereditary Basis for Congenital Dislocation of the Hip. (Genetics). A first hand study of affected families. This student is now engaged in Health Education at the State level.

McCann, Claire M., A Survey of the Literature on the Protozoa of the United States between 1935 and 1950. (Microbiology). This work contributed to a technical publication of the Michigan Academy of Science, Arts and Letters.

Oberdorfer, C. E., The Relation of the Endocrines to Shedding of the Skin in *Sceloporus undulatus.* (Physiology). This student is now a qualified Doctor of Medicine.

Sharpensteen, Helen, Identification and Classification of Algae Occurring within the Vicinities of Marquette and Caspian. (Plant Science). This student went immediately into graduate work and became a Doctor of Philosophy.

Todd, David F., The Vocal Apparatus of the Frog. (Morphology). This student was majoring in music education, minoring in biology. His demonstration material consisted of large scale, colored models, some of them "vocal."

Veeser, Donald, Nuisance Beaver in Michigan. (Conservation). This project won recognition in the form of a year's prepaid membership in the Michigan Academy of Science, Arts and Letters.

CASH AWARDS OFFERED TO SCIENCE TEACHERS

The National Science Teachers Association has been given a field investigation grant by the National Cancer Institute of the National Institutes of Health, U. S. Department of Health, Education, and Welfare. The grant is for the purpose of conducting a project aimed at increasing the effective, appropriate use of cancer information and educational materials in the teaching of high school general science, biology, chemistry, and physics.

Teachers of these high school sciences are invited to submit teaching plans and outlines for achieving the educational goals of the project. Cash awards will be given for those that are judged outstandingly good by a National Awards Committee. The best of these will then be published in a booklet which will be distributed to science teachers.
teachers.

Robert H. Carleton, Executive Secretary of the National Science Teachers Association will serve as project director, Secretary-editor of the project and the report will be Abraham Raskin, Professor of Physiology and Coordinator of the Sciences at Hunter College, New York City.

Additional information, entry forms, and resource materials may be obtained from the National Science Teachers Association, 1201 Sixteenth Street, N. W., Washington 6, D. C.

Using Maps as a Teaching Aid in Biology

JOHN D. WOOLEVER
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Detroit, Michigan

Most modern biology texts and manuals have a map or two illustrating a forested area or life zone, with relatively little explanation, discussion or analysis. Maps as such, showing mere distribution, rate little more than a glance and that is about all the notice a student gives them. The full potentiality of the map is not fully realized. Maps CAN be used to greater advantage than just as an illustration of distribution in a unit on conservation.

When field trips are impractical, certain phases of homework seem to be repetitions and there is a question arising as to whether the students are still THINKING in biology, that is the time that maps can be exploited in biology activities. They can be used with almost any unit of study and at any time of the year. They are suitable to use as home work, a project or a variation in library assignments.

Ordinarily a map tells you *what* is *where*. This is not always very important unless it helps to answer the why, when or how it got there.

A well planned map opens the way for thought, research and discussion on the part of the students rather than relying on the explanation of the teacher. It can stimulate an interest in a contemplated unit, tie in several units or summarize work completed . . . with a crystalization of ideas and objectives. As part of an examination it can act as a thought provoking question. It can give the student an awareness of numerous sources of information. It can develop an ability to sift pertinent material, give the student an opportunity to work as part of a research team and present a clear, concise report through the construction and interpretation of his map. Most important however, it demonstrates interdependence of organisms and environment, and stimulates the formation of hypotheses.

The map should be easy to handle, notebook size is preferable. Many large school systems provide pads of blank maps upon request. Teachers not so fortunate can reproduce an original diagram for distribution to the class. The teacher should have a supply of local city, county, state, national and world maps, for use during the semester. The most functional maps should include as many important features pertinent to the planned study as possible, although they may seem unrelated to the student at first. As the semester proceeds the size of the area studied should be increased to give the student a broader perspective of his part in the scheme of living things.

Boundaries, land marks and geological land formations to be included in the map depend on the nature of the assignment. If a city or community is to be studied, streets, parks, residential, commercial and industrial areas are very important. With classes that have little background, it can not be emphasized too much, just how important it is to have certain features already on the map before the student begins to work with the map. Needless to say this type of lesson correlates biology with many other subjects in the curriculum.

To facilitate reading and interpretation of the work, the students should agree on a legend of small but distinctive symbols that will be used to represent the objects on the map. Symbols such as stars, circles, squares, etc. are easy to see. However, a minute diagram of the objects in a distinctive color is very effective. The more distinctive the colors and symbols, the more objects can be used on the same map, thereby facilitating interpretation and multiplying its usefullness.

If time is limited and the map making is to be used as a student project, students can

make individual maps representing different phases on small glass or cellophane slides. These can be projected one at a time and super-imposed as various points are brought out. The advantage of this method is that all the students see the same thing simultaneously and the teacher can observe any descrepancies before the lesson.

The first step in the assignment is relatively simple. That is . . the request to indicate accurately the location of some specific items which are being studied. viz: cases of a disease, types of soil, national parks, etc. The number and nature of items to be located depends on what specific items the teacher wishes to correlate. It is the correlation that is to answer the how, when and why's.

To secure the required information, the student must use a variety of specialized books, encyclopedias, field trips, personal observations, surveys and other scattered sources of original information. The map condenses and coordinates the material collected.

When the maps are completed, it is the teacher's responsibility to pose some questions that can be answered simply, just to check the information collected by the student. These questions should lead to some of a more complex nature, not merely one of a factual nature, and not quite so evident. Gradually students will pose questions, many of these may eventually be unanswerable with the information at hand. What is important is that the students ask questions, form a hypothesis, and attempt to interpret their accumulated information. With some encouragement they may try to solve their new problems by doing further research.

The map can be exploited further by transfering the information to various tables, graphs and charts. This frequently facilitates interpretations and gives the student an additional opportunity to develop certain scientific techniques and skills.

Although by no means complete, the following is a list of subjects successfully used for map study in both general and college preparatory classes. It may be used as a nucleus of potential subjects and enlarged with the interest and general ability of the students.

Animals
anatomy
foods
natural enemies
distribution
varieties
domestication
habitats
fisheries
ranges
insects
house pests
migrations
hunting
marsupials
parasites
great apes

Conservation
erosion
farms
lumbering
new forests
natural parks
forest firs
reclamation projects
hunting areas
sanctuaries

Plants
wild species
cultivated
foods
drugs
spices
pests
seeds

Miscellaneous
races of man
early man
fossil types
soil types
blood types
life expectancy
population increases
explorations
rainfall
water sheds
ports and transportation
educational facilities
health laws
unusual diseases
mineral deposits
quarantine laws
medical facilities

Miscellaneous
plagues
sanctuaries
temperature
climate
altitudes and depths
social customs
standard of living
occupations
rainfall
ancient through modern time
immigation laws
immigation figures
starvation area
natural barriers
artificial boundaries
early geography
specific agricultural products

With such a list the teacher can vary the assignments at any time with little effort on his part merely by selecting any combination of different subjects for comparison and correlation. eg: ports, immigration figures, quarantine laws, diseases, plagues, insects, or: forests, animal distribution and population, hunting areas, national and state parks, conservation laws, water sheds, specific plants (animal foods), soil types. Basic question: How does each affect the others?

Eventually the students will wish to compare data not assigned by the teacher and this is only one indication that the map assignment has been stimulating and a step in achieving one of the many objectives in science education.

Animal Feeds Produced by the Modern Beverage Distilling Industry

LAWRENCE E. CARPENTER
Executive Director, Distillers Feed Research Council

One of the oldest biological phenomenon observed and utilized by man is the fermentation of grains in the preparation of fermented beverages. Some of the first work in bacteriology was concerned with theories regarding the mechanisms involved, but it was not until 1860 that Pasteur suggested that fermentation is a biological process brought about by microorganisms. Scientists have since learned that microorganisms can be used to produce industrial chemicals such as alcohols and acids, vitamins (riboflavin and vitamin B_{12}), antibiotics (penicillin, streptomycin, etc.), and many other materials of economic importance.

The modern beverage distilling industry was established after repeal of prohibition. Although the primary product of the industry is spirits, one of its important and interesting activities is the recovery of high quality animal feeds from the de-alcoholized fermentation residues. By using highly specialized technics, the industry makes cereal grains serve a dual role. They serve as a source of energy for the yeast cells that carry out the fermentation and, after the process is completed, their residues are recovered as distillers feeds. These feeds are used by feed manufacturers to make all types of livestock and poultry feeds. Today, almost 100% of the spent stillage is returned to our agricultural economy—approximately 85% is dried and returned to the farm in mixed feeds and it is estimated that about 14% is fed wet to livestock on farms near distilleries.

The industry normally processes approximately 1.5% of the nation's grain supply and produces 300,000 to 350,000 tons of feed annually. Over six million tons of distillers feeds, valued at aver $350 million, have been produced since resuming operations in 1933. Production reached an abnormally high level in 1944-45 when the industry was working on an around-the-clock basis to produce alcohol used in the synthesis of rubber, munitions, and other chemicals related to the war effort.

The basic materials used in the production of spirits are cereal grains, barley, malt and yeast. The grains, usually corn and rye, supply energy in the form of starch; barley malt is used as an economic source of starch-splitting enzymes which convert the grain starches to sugars. The yeast cells convert the sugars to alcohol.

In a typical plant operation (Flow Diagram, Figure I), the cereal grains are ground in mills and are then mixed together. The proportion of cereal grains and barley malt used is referred to as the mash bill. The ground grains are cooked either by mixing with water and cooking in large tanks or by a "flash" process in which the grain mixture is subjected to steam under pressure for a short time. The grains are cooked to change the characteristics of the starch granules so they can be readily acted upon by starch-digesting enzymes.

The cooked slurry is cooled, ground barley malt is added, and the mixture is allowed to stand until the starches are converted to grain sugars. The mixture is again cooled, adjustments are made in acidity, and the mixture is then transferred to fermenters.

While the grains are being prepared, yeast cultures are being propagated from a single cell of a strain of *Saccharomyces cerevisiae* under special laboratory conditions (Figure 2). The fermenters are inoculated with the yeast culture and fermentation is allowed to take place for a period of from three to seven days.

The fermented mixture is then de-alcoholized and the spent stillage, which contains about 7-10% solids, serves as the raw material for making distillers feeds. Three feeds are produced by the beverage distilling industry, namely, Distillers Dried Grains, Distillers

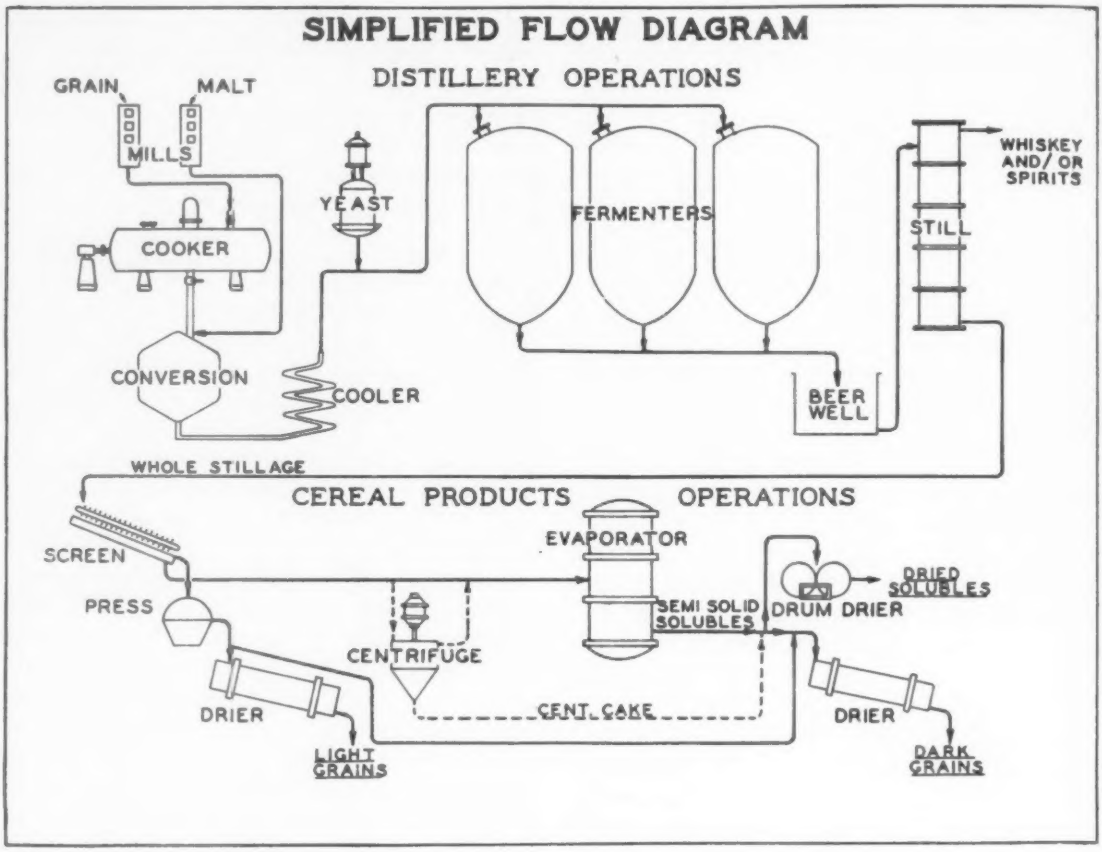

FIGURE 1

Dried Solubles and Distillers Dried Grains With Solubles.

Distillers Dried Grains is made by passing the whole stillage over screens (Figure 3), which separate the coarse, solid particles from the liquid and finely suspended portion. The material that passes over the screens is pressed to remove additional water and is then dried in large rotary tube driers.

Distillers Dried Solubles is made from a combination of the liquid portion of the stillage that passes through the screens and that which is pressed out of the coarse, insoluble portion. The liquid is concentrated in evaporators to a thick syrup and is then dried to a low moisture content on drum driers.

Distillers Dried Grains With Solubles is made by adding the thick syrup resulting from the concentration of the liquid fraction to the coarse, insoluble material that passed over the screens. The mixture is dried in rotary driers.

Distillers feeds could be considered concentrated cereal grains, for in the fermentation process, approximately two-thirds of the grain, the starch portion, is used. This means that all the other nutrients contained in the grains have undergone a three-fold concentration. Table I is presented to show that the fermentation process does not dissipate non-starch nutrients such as proteins, fats, minerals, and vitamins.

Some of the nutrients are found in larger amounts than anticipated. For instance, extra amounts of some of the vitamins appear in the feeds because they are synthesized by yeast during fermentation. The yeast cells actually manufacture many new chemicals which are undoubtedly used by the cell to carry out its metabolic process.

A typical analysis of the three feeds produced by the distilling industry is given in Table II. Distillers Dried Solubles is richest

in the water soluble nutrients since it is made from the liquid portion of the spent stillage which contains substances solubilized during cooking, digestion, and distillation, plus the microscopic yeast cells and substances formed during fermentation.

TABLE I

The Recovery of the Original Nutrients in the cereal grain fermented by yeast

Nutrient	Percent Recovery
Fat	106
Protein	97
Carbohydrates*	103
Crude fiber	95
Minerals	123
Calcium	300
Phosphorus	130
Riboflavin	150
Niacin	115
Choline	160
Folic acid	120

*Other than starch and grain sugars.

TABLE II

Typical Analyses of Distillers Feeds

	Light grains Typical mash bill	Grains with solubles Typical mash bill	Solubles Typical mash bill
Moisture, %	8	8	5
Protein, %	26	27	30
Fat, %	8	8	11
Fiber, %	12.5	9	4
Ash, %	2	4	7
Calcium, %	.09	.4	1.4
Phosphorus, %	.4	1.0	1.7
Vitamins in milligrams per pound—			
Thiamine	0.5	2	4
Riboflavin	2	4	8
Niacin	21	30	50
Pantothenic acid	2	4	7
Choline	600	1,000	2,500
Biotin	...	...	1
Pyridoxin	...	...	4
P-aminobenzoic acid	...	...	4.5
Folic acid	...	...	0.5

TABLE III

Weight Increase of Broadbreasted Bronze Turkey Poults Fed 5 and 10 Percent Distillers Dried Solubles

Supplements to Basal Diet	Average Weight at 6 Wks. gm	Response Over Basal %
None	1182.0	0.0
5% Distillers Dried Solubles	1293.0	9.4
10% Distillers Dried Solubles	1354.5	14.6

FIGURE 2. Propagation of yeast cultures used in fermentation.

The nutritional properties of distillers feeds have been evaluated by outstanding nutritionists in many of our universities and agricultural experiment stations. Controlled tests have demonstrated that Distillers Dried Solubles is an excellent ingredient for use in the manufacture of feeds for chickens, turkeys, calves, and swine. It is a rich source of protein, fat, riboflavin, choline and other water soluble vitamins. One of the outstanding properties of solubles is that it contains unidentified nutritional factors. These unknown vitamins increase the growth rate of animals fed diets containing adequate amounts of all the known essentials. These unknown vitamins are probably formed by the yeast cells during the fermentation process.

The excellent nutritional properties of Distillers Dried Solubles, plus its low fiber and moisture content, make it an ideal ingredient for poultry diets. Relatively small amounts are generally used and often are used to replace more expensive ingredients such as milk and yeast products.

Poultry nutritionists in colleges and in the feed industry have recognized the nutritive value of Distillers Dried Solubles and have conducted many tests to investigate its growth promoting properties. The results of these experiments usually indicate an increased growth rate with a better conversion of feed to meat. This is especially true when the diets lack sources of the unidentified factors.

FIGURE 3. Shaker and screen for removing the insoluble portion of spent sillage.

The experimental results given in Table III were secured at Texas A & M College. The basal diet was composed of proteins of plant origin supplemented with growth stimulating antibiotics and adequate amounts of all the known vitamins and minerals. In these tests, the increase in growth rate and better utilization of feed was attributed to the presence of unidentified factors.

Early weaning of dairy calves to conserve milk for human consumption has been made possible by using a limited whole milk feeding program, supplemented with dry milk replacer formulas. At Pennsylvania State College, the amount of whole milk necessary to raise dairy calves successfully during the first few critical weeks of life was reduced from 350 to 50 lb. by using a milk replacer which contained 10% Distillers Dried Solubles. In addition to the saving in whole milk, the cost of raising calves can be reduced by using Distillers Dried Solubles to replace all or part of expensive ingredients such as dried skim milk, whey, and dried brewers' yeast, without affecting rate of gain or adversely affecting the health or well-being of the animals.

Distillers Dried Solubles can be used advantageously and economically for pigs on dry lot and on pasture. Feeding 10% Distillers Dried Solubles, or a combination of 6% solubles and 4% alfalfa meal, in a complete diet for gestating-lactating swine improved reproduction performance. At the University of Illinois, sows fed diets containing solubles produced stronger and healthier litters, and the growth rate of the pigs after weaning was faster than that of pigs farrowed by control dams.

Distillers Dried Grains and Distillers Dried Grains With Solubles are used mainly in dairy and beef cattle feeds. They, too, are good sources of protein and fat. They are very palatable and bulky and, when added to dairy feeds, these characteristics improve the texture and palatability of dairy rations.

Milk cows fed rations containing distillers feeds produce up to three pounds more milk per day. Why these feeds increase milk production cannot be readily explained. It is postulated by some scientists that they contain unknown substances that stimulate milk flow. Another explanation is that they contain substances that aid in the digestion of the cellulose in hays and silages, thus increasing the total available energy values of rations.

The modern beverage distilling industry recognizes its role in the agricultural economy. In order to find the best use for the feeds produced by the industry, it has formed the Distillers Feed Research Council, an organization devoted to guiding and supporting nutritional research on the feeds produced by the industry. The Council supports research projects on all classes of livestock and poultry at eleven colleges and universities. Important findings and observations are made available at yearly conferences which attract nutritionists from colleges, universities, government agencies, and the feed industry. Observations that have practical application are adopted by feed manufacturers and the benefits of the research reach the livestock producer through the feed bag.

Plant Projects With or Without A Greenhouse

M. C. LICHTENWALTER
Wells High School
Chicago, Illinois

Plant Seedlings—In March or early April germinate seeds in flats. These may be vegetables like tomatoes, cabbage, peppers, and other warm weather crops; or they may be annual flowers like zinnias, petunias, marigolds, and similar summer flowers. For states farther south start plants three to four weeks earlier and for northern states two weeks later. Seedlings should be transplanted at least once before setting them out.

School Garden—Lay out and plant a school garden, with the plants grown in the preceding project, for the beautification of your school. Early blooming plants as marigolds and petunias will bloom before school is out; late blooming ones as snapdragons will bloom in the fall. A demonstration school vegetable garden would be a timely community display project.

Classroom vine—Secure a sweet potato that has not been kiln dried, (drying kills germination), insert three tooth picks, nails, or splinters about its middle and place one end in a water beaker supporting a portion of the potato above the water level. Place this in the window for strong light and in a few weeks, "voila"—vines.

School Nursery—Make hardwood cuttings of trees and shrubs of a number of local varieties in the late summer or early fall. In early spring plant these out in rows in the garden for cultivation. A few years growth will make stock suitable for school plantings.

Building Improvement—Use your greenhouse as a reservoir for plants growing in window boxes and other areas as the offices and corridors. Here they may be repotted or replanted, exchanged for a period for a new view of other selections, or for a resting period to revitalize them.

Narcissus bulbs—All types can be forced and winter hardy, standing freezing temperatures. The exceptions to this are the paper whites which, in addition, are forced in stones and water. They are not winter hardy.

Soilless Plant Growth—Hydroponics, tray agriculture, tank farming, or water culture may be tried with one or more of the chemical sets in the commercial market. Compare the growth of seedlings in screen wire supports, sand, excelsior, and vermiculite immersed in the aqueous chemical solution.

Vitamin Experiments—Try fertilizers with and without vitamin additions and check re-

sults. Many facts are still in the experimental stage of tentativeness, but an advanced group of students may find interesting results.

Hormone Stimuli—There are several products on the market for stimulating root growth and they can be checked with seedlings or rooting cuttings.

Albino Corn—Obtain seed from your supply house and plant in a seed flat. After a period of two weeks seedlings will reveal the presence of the recessive characteristic. Mendel's Law is demonstrated very nicely in this experiment. Pure albinos will not develop as they have a chlorophyll deficiency.

A Cut Flower Crop—In the early fall start a cut flower crop in the greenhouse. Your crop might be one or more of the following: sweet peas, calendulas, stocks, snapdragons, violets, marigolds, or carnations. These come into bloom in from three and one half to eight months, according to the season, growth conditions, and other factors.

Flower Show—A flower show is an excellent means of selling biology to the rest of the student body as well as making them flower conscious. It nets big returns in good will.

Soil Sterilization—Try conditioning some spent soil of the greenhouse, from a crop, by sterilization with steam, hot water, baking, or chemicals. Have the students search for the difference between this process, a standard procedure for greenhouse soil, and that of pasteurization.

Plant Groups—Set-up plant habitat-association groups including xerophytic, mesophytic, and hydrophytic conditions. The fleshy succulents and cacti are easy to maintain in a laboratory and always attract considerable attention. They may be grafted easily with a sharp knife; use a tooth pick to hold the parts into place. There are several of the sedges, lilies and arrowheads on the market which may be used in the aquatic groupings. In a bog group you may include the mosses, insectivorous anomalies, with those household plants the sansevieria and philodendron. A woodland group of mosses, lichens, liverworts, club mosses and ferns is an instructive and attractive demonstration. A tropical habitat may be made from some of the smaller palms, citrus fruit seedlings, and other tropicals common as household plants.

Fertilizer testings—The next decade will show as much improvement in fertilizers and their application as there was in the development of hybrid field seeds. Set up a few test plots either in the garden or grass of the lawn. The plots should be equal in size with the control. Try a plot of organic fertilizer which includes the manures, sewage disposals, and those new mixtures from fish, tankage, dried blood, cotton seed meal, boron and the trace elements. Use another plot with the commercial fertilizers. The fertilizers mentioned should be applied with a spreader if possible. On another plot try one of the liquid fertilizers coming on the market this year for commercial growers. It may be applied with the ordinary insecticide sprayer.

STIP

PAUL KLINGE
Howe High School
Indianapolis

STIP is the designation for a program all science teachers will be hearing much more about. It stands for Science Teaching Improvement Program and is the result of a $300,000 grant from the Carnegie Foundation to the American Association for the Advancement of Science. A pamphlet describing the proposed program may be obtained by writing Dr. John Mayor, AAAS Headquarters, Washington, D. C.

The Cooperative Committee for the Teaching of Science and Mathematics is a standing committee of the AAAS, and NABT is a participating member. At its Fall meeting in Washington, D. C., Oct. 21 and 22, 1955, NABT was represented by Paul Klinge. Chief topic of discussion was STIP. Led by its chairman, Dr. Mayor, the discussion centered around recommendations and advice for future action of STIP. The Committee heard Dr. John Coleman of the National Research Council tell of its program for the school systems of the Washington area for the improvement of science instruction. It was an exciting story of how one person has, by use of local resources, helped to raise the quality of science teaching and teacher morale.

Determination of Chromosome Numbers as a Laboratory Exercise for College Undergraduates

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University of Hawaii

Original research is the basis of science, yet college students may receive a bachelor's degree in science without ever attempting to make a new discovery. Although it is necessary for undergraduate students to retread the stairs traveled by their predecessors, and often at a lively clip, nevertheless original research is stimulating to the student, productive to science, and rewarding to the instructor. Weaver (*3*) has discussed the question of research and the undergraduate student.

The great difficulty with research for the undergraduate in modern science is that problems are frequently too complex and too time-consuming. The determination of plant chromosome numbers, however, does offer the possibility of a valuable project for undergraduate science students. It provides a stimulus to the student to survey the literature; it necessitates a good technique and encourages him in original research. Given favorable material, such a project is capable of being completed within the time limits imposed by a one semester course. At the same time a significant, if small, contribution is made to science.

The possibilities inherent in this project have led the author to encourage students in his cytology classes to spend some time investigating species not previously studied cytologically.

The proximity of a flora still relatively unknown cytologically has been, in the present instance, a stimulating factor. The native flora of Hawaii consists largely of unique species, there being endemic to the Islands, according to the estimate of Fosberg (*1*), over 94 per cent of the species of seed plants.

Although there have appeared from time to time chromosome counts of individual species, the recent paper of Skottsburg (*2*) which came to the writer's attention while this paper was being written, is the first to deal entirely with chromosomes of native Hawaiian plants.

The introduced flora is somewhat better known cytologically than the native, having been studied both abroad and in Hawaii. Our knowledge of it, however, is far from complete.

The lack of a dormant period is definitely favorable to a research project as envisaged here, allowing students free choice of materials and opportunity for field collections. Students in winter classes held in regions where there is a dormant period, may still work on such a project by utilizing greenhouse material.

It perhaps should be emphasized, that the determination of chromosome number is but one facet of laboratory work and then introduced only toward the end of the course. At such a time the student will have had opportunity to study prepared slides and will have gained some facility in preparing his own from known favorable material.

Even so, chromosome determination of new material is attended by difficulties. Collection of native materials is difficult since in Hawaii the plants, with few exceptions, grow in the mountains and are accessible only by foot trails. Fixing fluids must be taken into the field. First collections, if inadequate, can sometimes be repeated only with difficulty and in the case of flowering material may perhaps not be repeated for some time—an insurmountable obstruction for a classroom exercise. Some species, also, may not lend themselves readily to cytological study. This is particularly true

[1] This work was carried out while the author was a member of the Botany Department of the University of Hawaii. His transfer from that department and the relinquishment of some of his teaching duties make this report desirable at this time.

for the beginner who sometimes finds all his available time taken in mastering the technical difficulties of the plant he has chosen.

It is not expected, therefore, that each student will make an accurate chromosome determination, but rather, that the exercise be considered as a means rather than as an end in itself. Students should be made to realize that even though they are not completely successful in making a determination, the experience gained is sufficient justification for the project; otherwise some are certain to feel frustrated.

Students who have participated in this program have shown great enthusiasm. Their chief complaint has been lack of time. Since the project is but one segment of a course and since students are apt to be carried away with it, laboratory time assigned to this project must be limited. The amount of time assigned should be determined by the instructor considering other components of the course. Some students will wish to complete the project in their own time if they have not been able to do so in the regular laboratory periods.

While the program, as outlined above, has proven of considerable value in stimulating students' interest, a similar project undertaken apart from actual course work has proven to be of even greater interest. Undergraduate students at the University of Hawaii, usually in their senior year, are allowed to register for directed research. Students electing to do so may therefore investigate the chromosomes of a group of related species. Since such students presumably have already had some experience in slide making and since the time which they elect to spend on such a research project is devoted entirely to this phase of their work, it is usually possible to overcome any technical difficulties and achieve satisfactory results.

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Audio-Visual News

EMERY L. WILL
State University Teachers College
Oneonta, New York

Extension of film showings right into a lighted classroom has been made possible with the new Duolite 16 mm. film projector. This versatile machine features a built-in screen, about the size of a home television picture, and even color films are reproduced brilliantly in ordinary light. By flipping a lever, the picture may be projected onto a regular screen in a darkened room. This is a product of Technical Service, Inc., 30865 Five Mile Road, Livonia, Michigan.

The release of AMERICAN SEASHORES brings to a total of seven the number of popular Golden Nature Guides produced in filmstrip form by Young America Films. Like others in this series, AMERICAN SEASHORES is based on the Simon and Schuster book of the same title, and it consists of four filmstrips in color, depicting all of the illustrations in the book. Arrangement of the material makes possible the use of the book as an index and manual. Other sets in the series are: AMERICAN BIRDS, AMERICAN WILDFLOWERS, AMERICAN TREES, AMERICAN INSECTS, AMERICAN REPTILES AND AMPHIBIANS, and AMERICAN MAMMALS. Further information may be obtained from Young America Films, Inc., 18 East 41st Street, New York 17, N. Y.

Young America Films also announces the release of set II of the filmstrip series, PRINCIPLES OF BIOLOGY. Prepared for secondary schools and colleges, these six new filmstrips deal with environmental change, heredity, survival, health and disease, origin of living things, the descent with change. Set I, which was released several months ago, treated energy and life, life processes, interdependence, structure, and behavior.

A new aid to the development of photography programs in high schools is the Argus School Camera Kit, and biology teachers apparently are taking advantage of the unit to produce their own classroom illustrations. Information can be obtained from the Educational Services Division, Argus Camera, Inc., Ann Arbor, Michigan.

Now you can present sound-slide programs automatically, without the need for a projectionist or a narrator. This phenomenon is made possible with the La Belle Professional 75-slide projector and Control Recorder, through the placing of 1000-cycle notes on the commentary tape at points where the slides are to be changed. Write to La Belle Sales Corporation, Oconomowoc, Wisconsin, for information.

Audio-visual materials from abroad continue to speak well for themselves. Since many biology teachers may not be aware of their availability, it seems well worth mentioning a pair of recent filmstrips in color, HEREDITY (PART I) and HEREDITY (PART II). Although these filmstrips are shorter in length than many American products, they illustrate such important concepts as gamete development, meiosis, Mendel's laws, lethals, linkage and polyploidy. Along with other releases on the blood and circulation, HEREDITY may be obtained from Marian Ray, 36 Villiers Ave., Surbiton, Surrey, England.

"The Amazing Monsieur Fabre," an eloquent screen biography of the very poor French boy who trained himself to become one of the world's great entomologists, now is available for distribution in the United States. Coupled with the biographical material are sequences of insect life as seen through the eyes of Fabre. The ninety-minute film with English dialogue, may be obtained from Contemporary Films, Inc., 13 East 37th Street, New York 16, N. Y.

The filmed programs in the CBS television series, THE SEARCH, have been released for distribution from Young America Films. Each program documents a research project being conducted in an American university. Among the units now available are: DEAFNESS (Johns Hopkins University); NOISE AND HEALTH (University of California at Los Angeles); HEART DISEASE RESEARCH (University of Minnesota; and MENTAL ILLNESS, Parts I and II (Tulane University).

Biology teachers in the Chicago area will be interested in attending the Third American Film Assembly, spotlighting the Golden Reel Film Festival, at the Morrison Hotel, Chicago, April 23 to 27. Hundreds of the latest film releases will be screened, and audio-visual producers will exhibit. The Sound Slidefilm Conference also will continue as a part of this assembly. Details of the program will become available from the Film Council of America, 600 Davis Street, Evanston, Illinois.

Some recent film releases:

THE HUNTER AND THE FOREST. 8 min., musical score, b. & w. Filmed in Sweden, no words are spoken, and audience is to draw its own interpretations. Presents concepts of forest habitats, forest animals (black grouse, deer, marten), and conservation of wildlife. Stimulus to creative writing and to careful observation. Primary grades through high schools. Encyclopedia Brittanica Films, 1150 Wilmette Avenue, Wilmette, Illinois.

RADIOISOTOPES: THEIR APPLICATION TO HUMANS. 32 min., sd., color. Detailed review of the use of radioisotopes, including tracer studies and therapeutic treatment of the patient. High school and college. Medical Film Guild, Ltd., 506 West 57th Street, New York, N. Y.

PUMP TROUBLE. 13½ min., sd., color. Heart disease, and the importance of thorough examination by a physician. High school and college. American Heart Association Film Library, 44 East 23rd Street, New York 10, N. Y.

THE VALIANT HEART. 28½ min., sd., b. & w. Especially aimed toward parents and teachers, to present facts about rheumatic fever. High school and college. American Heart Association Film Library.

BOUNTIFUL HERITAGE. 21 min., sd., color. How varieties of flowers and vegetables are breeded to meet the needs of home gardeners and commercial growers. High school and college. Ferry-Morse Seed Company, P. O. Box 778, Detroit, Michigan.

Filmstrip Series, THE WORLD WE LIVE IN. Color filmstrips corresponding to the chapters in the book-feature of Life Magazine. Already completed are: REPTILES INHERIT THE EARTH; THE AGE OF MAMMALS; CREATURES OF THE SEA; THE CORAL REEF; THE DESERT; THE ARCTIC TUNDRA; and THE RAIN FOREST. THE WOODS OF HOME should be completed by early 1956. Address: Life Filmstrips, 9 Rockefeller Plaza, New York 20, N. Y.

What Kind of Biological Education?

WILLIAM GOULD VINAL, "CAP'N BILL"
Emeritus Professor Nature Education
University of Massachusetts at Amherst

It has been my privilege, for nearly half a century, to help college students find a new pattern in outdoor education by which they could equip others to live and teach effectively as working members of a democratic community. My way of teaching is not copyrighted. As I must pass on the torch to younger hands, it is up to me to present the drama of teaching as the challenge and opportunity I believe it to be. It is an attitude or a fellowship; a guidance but not prescription; an "experience laboratory" rather than a "classroom lab." These three concepts are easy to say but difficult to "savvy," not to mention to accomplish.

My procedure certainly differed from the run-of-the-mill, hour-ordered courses in biology. For example there was no saturating the student with data about the anatomy of the earthworm and crayfish as a method of solving individual biological problems.

Reality in present-day biology consists of going to the country for vacation time, sitting on a wind-swept hill in preference to an air-conditioned "lab," participating in *something real* instead of sitting in a lecture hall, baiting one's own hook, raising one's own food rather than being dependent on a can opener or (scalpel), lying on the ground to watch an ant city, keeping a hive of bees, practicing conservation by evaluating an area as a potential wildlife sanctuary. To my mind these are biological events which can be experienced in any community. The problem of implementing liberal biological experiences is a practical one. The core idea is that the individual must become aware of the aspects of biological processes in his own community if he is to gain growth in knowledge, attitude, and practice.

Biology can be the science of human affairs. A class in biology, or better a biological family, is similar to a large farm family in which the individuals have different ages, maturity, interests, aptitudes, duties, and plans for a career. Instead of being designated as biology "majors" it would be more correct to consider them as concentrating in the broader field of nature education. It is not a matter of "squeezing" all comers into subject specialization, but rather of orienting the individual to experiences. A novice might have to spend a whole year in "finding himself."

It is not unusual for students to need to earn money. Job opportunities are, therefore, an influencing factor. In favorable years Connecticut Valley farmers need apple pickers. This is considered a good experience but is not accepted as "field credit." Other examples are the sundry jobs on a college farm, such as being in charge of the maternity ward in the cattle barn. It is biological and of high value as experience. A field job, for credit, consists of professional biological field services offered to interested Connecticut Valley neighbors: A Youth Center in the Berkshire Hills serves needs in fishing and camping; making a nature trail for the Northfield Inn; organizing a Trailside Museum at the Mt. Tom State Reservation. Biology, the study of life, thus becomes a live need within within the community. This gain in biological interests, which are honest-to-goodness life problems, is quite different from accumulating hours of "clocked laboratory time" in botany or in zoology.

Don't think that this kind of work does not require knowledge. A person leading a group of teenagers is placed on his "metal." He has to know a lot more about biology than found in a dissecting pan. He must have the ability to handle words, people, situations, and subject matter in a different environment.

A "Prof" should know beans. The development of a bean is much like the development of a student. It is important to know that

there are different kinds, such as: string, kidney, wax, soy, and limas. Beans, like people, may be white, black, brown, red, and yellow. A bean plant depends on its heredity and environment for healthful living. Beans and people have to grow their own way without to much meddling. Nevertheless there is orderly procession of seeds, leaves, bud, flower, fruit, and usefulness. The evolution of a plant is dependent on chemical and physical laws such as osmosis, capillary action, and photosynthesis. It is only by looking at beans in the "scheme of things" that students (and "Profs") can comprehend and understand the *WHOLE*.

"Kinds of beans" is an abstraction. So is the anatomy or health of beans. Botany is an abstraction. The question is, are we to teach abstractions and place them in separate cubicles of the brain or are we to know beans, and students, in relation to a dynamic society?

Fortunately, biology does not have to be an ordeal. It can be so revealing that students want to go *biologizing*. The professor has to see the whole picture first. The "Prof" who really knows the biology of beans will have convictions on utilizing the same biological laws for the development of humans. The processing is not the blending of the occupants of "lab-cages" into a type. To quote Emerson, "Who would be a man must be a non-conformist."

The Curriculum. This is a new kind of biology, or at least it's one which has not been practiced since the days of pioneer families who got their "schooling" in the 3R's in the one-room District School. It is the resetting of the traditional values for "experiences" in today's world. The curriculum consists of work experiences of two kinds: the academic year within the local school area and the so-called vacation time in more distant places. Another classification of the curriculum might be: Campus living, neighborhood living, home living, on-the-job living. The curriculum (intra- and extracurricular) is total living for growth. The student experiences an over-all maturing.

The Freshman-Sophomore courses at the University of Massachusetts, give a thorough ground work in the "tool courses," such as English, mathematics, beginning biology, chemistry, and physics. The Junior-Senior concentration ("major") consists of choosing electives for their interest and capacity. Students will want to know how to handle such things as statistics, graphs, maps, child care. They may have a hunger for more courses in geology, education, literature, sociology, and history. They are pursuing a liberal education in biology for modern living. The individual must be thought of in a field form of society centered around problems of humanity. It is believed that the minimum essentials of basic knowledge would be a by-product rather than an end-product of education.

Campus Living. The campus can be a rich environment with a student-planned campus life. Responsibility is more than an individual matter. First of all, a student has responsibility to himself, present and future. Secondly, it should be realized that the loyalty, responsilibity and cooperation of the biology group is expected. Activities should be noted for vitality and enthusiasm. The only advice needed is not to get into too many extra-curricular activities. Three varied campus responsibilities per year are considered a liberal contribution to "wholeness": Outing Club, Bird Banding, Nature Photography, Hosteling, Scouts are examples. It is of utmost importance that this new brand of biology student must first of all be a human being.

Students of nature have a common understanding that their object is to promote mutual interest and social happiness. With us, excursions to the Berkshire maple sugar orchards and the singing of Christmas carols would be examples. Student teams might put on radio skits, attend camp clinics, cover conventions. A Nature Guide Newsletter can be highly successful and amusing with inserts such as, "The specimens (Snakes from California) Joe sent are doing well—they seem to be a swell attraction, but do they keep me busy chasing bugs," or "Hosteling along the Yukon by your Kodachroming tourist."

Work experiences. Academic ideas and living in society are often miles apart. Nerve ganglions in an earthworm have little to do with a student's biological attitude and practices in the 1956 village. One may live the "good life" as a typical biology teacher and not have the remotest concept of handling

the environment in a practical direction. Below are described some practical work experiences:

(1) *In the Home Town.* Each student can survey his home town for: Community facilities, population, and use, climate, housing, and nature recreation. This is a popular study and may include students from diverse fields of interest which bring a certain standard to a group. There is no home town but what needs to measure up to the high standards of expectancy for convenience, safety, health, and beauty. When the student lifts his sights to the needs of the community he knows he is approaching his status in ability to measure a useful and liveable scheme of things. If he does not wear the smoked glasses of hometown prejudice, he may be startled to see some chaos, smoke, din, mud, and blight. He also may be enthused at the potenital greenbelts, waterways, vistas, parkways, the charm of old houses, and admirable planning.

(2) *The Summer Job.* Living experiences in the summer is quite different from going to summer school to analyze more type specimens. It will be necessary to describe a few jobs to make this clear.

(a) Camping is really the biology of humans as related to the 24-hour-day, natural environment. It is a renewed concern with the ancient science of primitive living as modified by modern knowledge of health and education. The program changes day to day, weather to weather, mood to mood. This new science of human ecology brings forth problems of shelter, food, water, clothing, and program. Humans, especially urban humans, have forgotten about their dependence on nature. If they eat canned beans they think that beans are made available by can openers. A nature counselor gains prestige. Campers will look to him as the authority, not only on beans, but on poison ivy, foraging, compass directions, what to conserve, etc. He can be paid for having a good time. It is also fun to rub elbows with other young people who have kindred interests but quite a different course of study in school. By the second summer a nature counselor is three to five times as valuable as he was the first summer.

(b) Others. A summer Inn might employ a nature guide who is also skillful in golf, outdoor cookery and swimming. A Forest Reservation may require a naturalist who can direct a trailside museum, run an evening camp fire program in the amphitheater, and write for the local papers.

Going out into the world as an individual with something to give, and something that society wants, is both adventure and excitement. The student who has two or three such job experiences gains a broadening confidence in skills, knowledge, and often discovers unknown talents. In the long run, the broader the experience the stronger the preparation. In each instance promptness, dependability, workmanship, and cooperation are necessary for success, rather than mere "noblesse oblige" to biological knowledge.

(3) *First Permanent Job.* There are said to be 20,000 ways of making a living but that does not mean a career. A career in field biology means a satisfying, worth-while achievement outdoors. In looking over the careers of this brand of graduate I feel that there are about twenty-four fields of endeavor, besides that of housewife: teaching, youth work, museums, therapy, recreation, conservation, Audubon, camping, writing, and community service are the more usual categories. The succession of experiences on campus, in town, and during the summer are occupational trends. Each job setting had a minimum of rules imposed by the instructor but a maximum imposed by public opinion.

What each individual was in the past, what he now is, and what he becomes in the future is a continuous program. One's biological make-up, plus experiences, adds up to behavior and personality. I recall one student who never talked. The reason was that he stuttered when a boy and people laughed at him. He is now a ranger naturalist in a national park, in summer and a children's museum worker in winters.

To this point this article has been concerned with outlining a program of education in field biology for the cause of human ecology. Moreover, the thesis has been directed toward professors and students who may have more than usual interest in the role of biology as a way-of-life. Progress in this brand of biological education has been made on the principle of ADAPTATION as set forth by Dar-

win a century ago. It is based on the idea of helping free people to maintain their in-individuality. Interdependence is also a basic principle. Since sufficient orientation in human engineering is not found in biology textbooks or in dissecting pans there has to be concentration based on life as it is found.

These suggestions are not presented as a panacea nor as a complete replacement for present day biological procedure, but rather as another pathway to biological education for leadership. There are a few remaining procedures that need to be emphasized if humanized biology is going to permeate our social structure as an ideal of free people. Thrusting students into a field of constant change is at the opposite pole from going to lab to soak up frozen facts. It is the recognition of a critical need for skills in human relations in a mechanistic world that prompts one to embark on training in career development in a natural world.

Report of Annual Meeting of

The National Association of Biology Teachers

Atlanta, Georgia, December 26-30, 1955

John P. Harrold
President, National Association of Biology Teachers

The National Association of Biology Teachers sponsored one joint session co-sponsored by ANSS and NSTA based on the theme "Science and Human Resources." Varied topics cove.ed the influence of science upon the South, practical methods of introducing radioisotopes to the high school student, the problems faced by Negro colleges in their efforts to prepare science teachers.

Two separate programs were planned by NABT. One stressed the coordination of science and education. Variations in teaching biological principles were demonstrated, summer programs for the biology teacher were outlined, and progress reports resulting from the recommendations of the Southeastern Conference on Biology Teaching were given by representatives from ten southern states. The reports showed that the recommendations of the conference, sponsored by a grant from the National Science Foundation and conducted by NABT, were seriously being undertaken by a majority of the states represented.

The second session was concerned with presenting new ideas to the biology teacher. These consisted of an illustrated demonstration of techniques for growing fern spores, the teaching values of animals and plants in the laboratory and the field, better use of visual aids and the use of the project method of training teachers in the biological sciences.

NABT also co-sponsored meetings with ANSS, NSTA, NARST and AAAS.

The Association officers for 1956, announced at an inauguration ceremony held just prior to the Thursday afternoon session, were President, John P. Harrold, Midland Senior High School, Midland, Michigan; President-elect, John Breukelman, Kansas State Teachers College, Emporia, Kansas; Past President, Brother H. Charles, F.S.C., Saint Mary's College, Winona, Minnesota; First Vice President, Irene Hollenbeck, North Salem High School, Salem, Oregon; Second Vice President, Howard E. Weaver, University of Illinois, Urbana, Illinois; Third Vice President and National Membership Chairman, Robert Smith, DeKalb High School, DeKalb, Illinois; Secretary-Treasurer, Paul V. Webster, Bryan City Schools, Bryan, Ohio.

Highlights of the business sessions were the plans for incorporation, plans for additional conferences on the improvement of biology teaching and the encouraging report made by the Secretary-Treasurer.

Biology in the News

BROTHER H. CHARLES, F.S.C.
St. Mary's College
Winona, Minn.

THE DOG THAT LOVED FOXES, William B. Mowery, *Sat. Ev. Post*, Jan. 7, 1956, pp. 43, 83-84.

A true story of a dog's devotion to a fox and her family. It contains much interesting information about the habits of foxes.

THE GLORY OF THE SEA, Jan de Hartog, *Sat. Ev. Post*, Dec. 31, 1955, pp. 55-62.

An illustrated account of the author's reactions to immense expanses of water. Not too much biology but an insight into the wonders of nature not to be missed.

UNCLE SAM'S ARK, Bill Wolf, *Sat. Ev. Post*, Dec. 3, 1955, pp. 31, 145-146.

An interesting account of the work of a United States Animal Quarantine Station; the kinds of animals handled; and the means used to protect the domestic animals against parasites and disease.

HE FIXES FISH, Wyatt Blassingame, *Sat. Ev. Post*, Nov. 26, 1955, pp. 24-25, 105-108.

Trophies made by Al Pflueger are wonders of the taxidermist's art. He combines an expert's knowledge of fish with the best methods, many of his own invention, of mounting them.

LEARNING FROM THE FOX, Dr. William J. Long, *Sports Illustrated*, Dec. 19, 1955, pp. 32-34, 63.

The habits of a fox as observed by a boy. The same experiences are possible to keen eyed students who walk in the woods.

FOR GARLIC LOVERS ONLY, Duncan MacDougald, Jr., *Colliers*, Jan. 20, 1956, pp. 20-23.

The uses of garlic range from medicines to staple foods, but most is used to add flavors to salads and meats. This article may stimulate discussion of this particular type of lily.

NEXT: FLUORIDE TOOTHPASTE, Bruce Bliven, Jr., *Colliers*, Jan. 6, 1956, pp. 32-35.

The controversy about fluorides and their effects on reducing tooth decay continues. Here is a glowing account of one town's toothpaste test and its results.

THE FABULOUS BRAZIL-NUT, Maurice Paul, *Coronet*, Jan. 1956, pp. 70-72.

A short, interesting account of the trees which produce them.

Books for Biologists

EXPRESSION OF THE EMOTIONS IN MAN AND ANIMALS. Darwin, Charles. The Philosophical Library, New York 16, N. Y. 372 pp. 1955. $6.00.

An extremely interesting book on the nonverbal aspects of human communication. The author discusses the expressions of astonishment, contempt, disgust, fear, and asks such provocative questions as "does shame excite a blush?" and "how low down the body does the blush extend?". Many are the rewards spent with Charles Darwin and his fresh and original inquiry.

BOTANY: PRINCIPLES AND PROBLEMS. Sinnott, E. W. and Wilson, K. S. 528 pp. $6.75. McGraw-Hill Book Company, Inc., New York 36, New York. 1955.

A successful standard work rewritten and brought up-to-date. The authors have expanded their material to include a large number of splendid new illustrations and fine photographs and discussion of the latest advances in plant science.

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